NUMBER 24

Proceedings

of

The Canadian Phytopathological Society

Twenty-third Session

JUNE 25-28, 1956

UNIVERSITY OF TORONTO
TORONTO, ONTARIO.

DEC 5 1956

Editorial Committee
RUTH M. HORNER
JEAN E. NEWMAN
V. R. WALLEN
D. S. MacLACHLAN

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ALLEN PRINTERS 89

The Canadian Phytopathological Society

LIST OF OFFICERS AND COUNCIL
1955-56.

President

W.F. HANNA, Botany and Plant Pathology Division, Ottawa, Ont.

Vice-President

R.E. FITZPATRICK, Plant Pathology Laboratory, Vancouver, B.C.

Secretary-Treasurer

D.S. MacLACHLAN, Botany and Plant Pathology Laboratory, Ottawa, Ont.

Councillors

W.C. BROADFOOT, Science Service Laboratory, Lethbridge, Alta.
F. GODBOUT, Bureau de la Protection des Plantes, Montréal, P.Q.

Copies of the Proceedings of the Canadian Phytopathological Society may be obtained from the Secretary-Treasurer at a price of 50c each.

Donald Channing Buckland
1917 - 1956

In the passing of Dr. D. C. Buckland, Associate Professor of Forest Pathology, University of British Columbia, the Canadian Phytopathological Society lost one of its most distinguished young members. He died on February 16, 1956, at Vancouver, B.C.

Dr. Buckland was born on July 9, 1917, in New Zealand. He came to British Columbia as a child and, except for a period as a graduate student in United States, had resided in that province since. He attended high school in New Westminster and then proceeded to the University of British Columbia, where he obtained his Bachelor of Science in Forestry in 1942. He took his graduate work at Yale University, where he gained his Master of Forestry in 1943 and his Doctor of Philosophy in 1945.

He began his professional career with the Canada Department of Agriculture in 1942 and worked for the Department during the summer months while taking his graduate work. In 1947 he was appointed Officer-in-Charge of the Forest Pathology Laboratory, Victoria, B.C. He remained in this position until 1948, when he accepted a teaching position at the University of British Columbia when the Powell River Company established a Chair in Forest Pathology.

Dr. Buckland served as an example of courage and determination to all his colleagues and friends. Although he was in poor physical health for many years, this affliction was compensated for by his keen inquiring mind and cheerful, optimistic mental outlook. Even when struck by blindness in 1951, he refused to slacken his tempo and he continued his research projects and his teaching duties with distinction. He proved to be an outstanding research worker, an inspiring teacher, and an active community leader. Although his interests in the field of forest pathology were broad, his major contributions were in the field of root diseases of conifers, on which he was author of a number of excellent publications. He was active in the Boy Scouts, the Canadian Institute for the Blind and the Canadian Institute of Forestry. He was director of the Institute for the Blind and president of the Vancouver Section, Canadian Institute of Forestry. He was a member of the terminology committee of the Canadian Phytopathological Society, where he assumed an active role in the preparation of a manuscript on forest disease terminology. It is anticipated that this, one of his last contributions, will be published shortly.

Dr. Buckland is survived by his wife, Jean Kirstine, two daughters, Elizabeth and Dorothy, and one son, David.

MINUTES OF THE TWENTY-THIRD MEETING HELD AT THE UNIVERSITY OF TORONTO, TORONTO, ONT., JUNE 25-28, 1956.

Business Sessions: June 25 and June 28.

The first business session was held in the Botany Building, University of Toronto. In the absence of the President, Dr. W. F. Hanna, the vice-president, Dr. R. E. Fitzpatrick welcomed the members and visitors to the 23rd Annual Meeting of the Society. Dr. D. L. Bailey extended a welcome to those present on behalf of the staff of the Botany Department, University of Toronto.

The minutes of the twenty-second meeting were adopted as printed in Proceedings No. 23 on motion of Wm. Newton, seconded by L. T. Richardson. Carried.

It was moved by D. S. MacLachlan, seconded by G. H. Berkeley that the report of the Secretary-Treasurer be adopted. Carried.

The report of the Disease Diagnosis Committee was adopted on motion of D.S. MacLachlan, seconded by R. A. Ludwig. Carried.

It was moved by G. H. Berkeley, seconded by R. A. Ludwig, that the report of the Publications Committee be adopted. Carried.

It was moved by R. A. Ludwig, seconded by Wm. Newton, that the C.P.S. endorse the publication of a Quarterly Report by Science Service.

The following membership applications were approved by unanimous vote on motion of B. H. MacNeill, seconded by J. P. MacKinnon: Elizabeth Whittaker, Roy L. Millar, Thomas Simard, Jacques Simard, Ralph H. Estey, James K. Shields, James Reid, Robert G. Ross.

The following members were elected to the resolutions committee: W. C. Broadfoot (Chairman), Wm. Newton and H. Genereux.

The report of the Editorial Committee was adopted on motion by D. S. MacLachlan, seconded by R. C. Russell. Carried.

It was moved by H. A. H. Wallace, seconded by R. Stace-Smith, that the report of the Custodian of the Library and Records be adopted as read. Carried.

It was moved by W. C. Broadfoot, seconded by M. W. Cormack, that the distribution of the Proceedings be handled by the Secretary-Treasurer.

The report of the Nominating Committee was adopted on motion of W. C. Broadfoot, seconded by Wm. Newton. Carried.

It was moved by M. F. Welsh, seconded by G. H. Berkeley, that the report of the Terminology Commitee be adopted as read. Carried.

M. F. Welsh reported that a recommendation from the meeting regarding the publication of the Report on Forest Disease Terminology would be welcomed by the Canadian Institute of Forestry. Following a lengthy discussion, it was moved by M. F. Welsh, seconded by R. A. Ludwig, that the C.P.S. request publication by the Canadian Journal of Botany of the Surveys of Forest Disease Terminology and Terminology of Plant Virus Diseases when the Terminology Committee deems these surveys ready for publication. Carried.

It was moved by R. A. Ludwig, seconded by R. Stace-Smith that the use of Society funds for the purchase of reprints of the Terminology Reports be left to the discretion of the executive. Carried.

It was moved by W. C. Broadfoot, seconded by Wm. Newton, that the executive be authorized to form the new committees and to fill any vacancies on existing committees. Carried.

It was moved by Wm. Newton, seconded by G. H. Berkeley that an honorarium of fifteen dollars be granted to the Secretary-Treasurer for stenographic assistance. Carried.

The report of the Representative to the Canadian Society of Microbiology was adopted on motion of A. R. Walker, seconded by W. A. Hodgson. Carried.

It was moved by D. L. Bailey, seconded by L. C. Callbeck that the report of the Program and Publicity Committee be adopted as read. Carried.

It was moved by Wm. Newton, seconded by B. H. MacNeill that a letter be sent to Dr. Roy Young, Secretary-Treasurer of the A.P.S. (P.D.) inviting members of that Society to attend the next C.P.S. Meeting in Vancouver. Carried.

Following a discussion on C.P.S. affiliation with the A.I.C., it was moved by Wm. Newton, seconded by R. A. Ludwig, that the C.P.S. apply for affiliation with the A.I.C. if the present membership requirements of the A.I.C. are removed. Carried.

A letter from the Ottawa Biological and Biochemical Society requesting the opinion of the C.P.S. regarding the formation of an organization to hold annual federated meetings of Canadian Biological Societies was discussed. It was moved by Wm. Newton, seconded by W. C. Broadfoot, that the Secretary draft a letter expressing the interest of the C.P.S. in such an organization, but stating that the C.P.S. does not wish to take a formal stand at the moment. Carried.

It was moved by Wm. Newton, seconded by W. P. Campbell, that abstracts of papers to be presented at the Vancouver Meeting be mimeographed for distribution at the meeting. Carried.

The report of the Resolutions Committee was adopted on motion of Wm. Newton, seconded by F. J. Greaney. Carried.

COMMITTEES

Auditors: Mildred K. Nobles and J. W. Groves.

Custodian of Library and Records: W. L. Gordon.

Disease Diagnosis: H. W. Mead (Chairman), W. E. Sackston, L. E. Tyner, G. C. Chamberlain, D. J. MacLeod, Frances C. Mellor, W. A. Benedict.

Editorial: Jean Newman (Chairman), V. R. Wallen, R. A. Shoemaker, D. S. MacLachlan.

Nominating: W. F. Hanna (retiring president as Chairman), W. C. Broadfoot, R. J. Baylis, R. O. Lachance, W. A. Hodgson.

Program and Publicity: R. Stace-Smith (Chairman), W. D. Touzeau, W. McKeen, Wm. Newton, D. S. MacLachlan.

Publications: W. F. Hanna (Chairman), F. L. Drayton, G. H. Berkeley.

Representative to the Canadian Society of Microbiologists: A. R. Walker.

Resolutions: W. C. Broadfoot (Chairman), Wm. Newton, H. Généreux.

Terminology: M. F. Welsh (Chairman), W. A. F. Hagborg, B. H. MacNeill, H. M. Good, T. C. Vanterpool, R. S. Willison, R. A. Ludwig, W. E. McKeen, C. D. McKeen, D. J. McLeod, R. Pomerleau, L. E. Tyner, A. W. Henry, A. N. Langford.

Regional Representatives:

Maritimes	—	L. C. Callbeck
Eastern Quebec	—	D. Leblond
Western Quebec	—	F. Godbout
Eastern Ontario	—	R. J. Baylis
Western Ontario	—	B. H. MacNeill
Manitoba	—	W. C. McDonald
Saskatchewan	—	R. D. Tinline
Alberta	—	J. T. Slykuis
B. C. Mainland	—	R. Stace-Smith
Vancouver Island	—	R. E. Foster

REPORT OF THE SECRETARY-TREASURER

Mr. President and Fellow Members:

I have the honour of presenting the following report of the Secretary-Treasurer for the fiscal year ending March 31, 1956.

The 22nd Annual Meeting of the Society was held on the campus of the University of Alberta, Edmonton, Alberta, June 20-23, 1956. The C.P.S. Proceedings No. 23 contains an account of the business sessions, and abstracts of 23 papers which were read at the meetings.

Dr. J. G. Horsfall was guest speaker at a symposium, "Present Status and future trends in Fungicides", held in conjunction with the meetings.

A social evening was held on June 21 in the Men's Faculty Lounge, University of Alberta, at which Mr. J. G. MacGregor spoke on "The Early History of Alberta".

Membership in the Society has reached a total of 232, as compared with 218 in 1954-55. The election of 6 new members brings the total membership to 238.

During the year, word was received of the death of Dr. D. C. Buckland.

The attached financial statement shows a favourable balance of $262.16.

Respectfully submitted,

D. S. MacLachlan,
Secretary-Treasurer.

FINANCIAL STATEMENT

CANADIAN PHYTOPATHOLOGICAL SOCIETY

June 1, 1955 to May 31, 1956

Revenue:

Balance brought forward			$353.96
Fees:			
1953-54	$ 7.00		
1954-55	35.00		
1955-56	209.00		
1956-57	22.00		
1957-58	2.00		
		$275.00	
Interest on Bond		15.00	
Sale of Proceedings		3.00	
Naugatuck Chemicals		100.00	
			393.00
			746.96

Expenditures :

Coffee Party — Annual Meeting	39.84	
Dr. J. G. Horsfall — Expenses	125.00	
Photograph — Annual Meeting	5.00	
Projector — Universtiy of Alberta	3.15	
Honorarium — Stenographic	15.00	
Printing of Proceedings #23	248.41	
Postage	47.00	
Bank Charges and exchange	1.40	
		484.80
Balance (on hand) May 31, 1956		262.16

Additional Asset :

Dominion of Canada Bond (Series P 7Z95546)	500.00

Audited and found correct.

(Signed) J. W. Groves,
Mildred K. Nobles

REPORT OF THE CUSTODIAN OF THE LIBRARY AND RECORDS OF THE SOCIETY

The library of the Canadian Phytopathological Society on May 1, 1956, contained 832 accessions. Since May, 1955, the number of accessions has amounted to 93.

As a result of the resolution with respect to the library that was passed at the Twenty-Second session of the Society at Edmonton in 1955, Miss D. Luke, Librarian, Botany and Plant Pathology Division, Ottawa, was approached with regard to its disposal. Apparently any publications of phytopathological interest in the Society library are already contained in the library of the Division. Space is not available there to store the Society library.

The library has been discussed recently at a meeting with other members of the Canadian Phytopathological Society located at the Winnipeg laboratory. The consensus of opinion was that this library is not fulfilling any useful function, is taking up needed space, and that it should be disposed of and discontinued. It is suggested that unless the Society can arrive at some definite decision at this session about the disposal of the library, it be left to the Custodian and Regional representative of the Society for Manitoba to handle this matter as they see fit.

W. L. Gordon.

REPORT OF DISEASE DIAGNOSIS COMMITTEE

The scheme to use the facilities of the Biographic Unit, to build up a kodachrome library for the C.P.S. has received very little support. The committee concludes that no further action need be taken in view of the fact that a wide range of services is offered by the Biographic Unit.

The suggestion in our 1955 report that a revised check list be prepared, has been anticipated by Mr. Conners. He has given considerable thought to the form of a new check list and has prepared some preliminary outlines.

W. E. Sackston
L. E. Tyner
G. C. Chamberlain
D. J. MacLeod
Frances C. Mellor
W. A. Benedict
H. W. Mead (Chairman)

REPORT OF THE EDITORIAL COMMITTEE

The Proceedings of the Twenty-second Session of the Canadian Phytopathological Society were issued on January 23, 1956. They contain the report of the meeting held at the University of Alberta, Edmonton, Alberta, June 20-23, 1955, a group photograph of those in attendance, twenty-three abstracts of papers read at the meeting, a list of papers published by members between June 1, 1954 and May 31, 1955, and an obituary of Dr. John Dearness.

The editorial committee received the full co-operation of members in sending in material for the Proceedings. The abstracts of papers presented at the meeting were all in the hands of the secretary by meeting time and a good response was received to the request for the list of papers published. In Proceedings No. 23, only the references actually sent in by members were included in the list of papers published by members of the society. This reduced considerably the work involved in preparing the Proceedings for publication.

Jean E. Newman
V. R. Wallen
D. S. MacLachlan
Ruth M. Horner (Chairman)

REPORT OF THE NOMINATING COMMITTEE

The following slate of officers is presented for election as Members of the new executive of the Canadian Phytopathological Society :

President :	Dr. R. E. Fitzpatrick
Vice-President :	Mr. F. Godbout
Secretary-Treasurer :	Dr. D. S. MacLachlan
Councillors :	Dr. W. F. Hanna Dr. R. L. Pelletier

Respectfully submitted,

P. M. Simmonds
C. D. McKeen
T. C. Vanterpool
J. F. Hockey
W. C. Broadfoot (Chairman)

REPORT OF THE PROGRAM AND PUBLICITY COMMITTEE

The program committee, which consisted of D. S. MacLachlan, R. F. Cain, B. H. MacNeill, O. T. Page and D. L. Bailey was able to hold only one meeting which took place in Toronto in December. While the Toronto and Guelph members were able to discuss matters incidentally from time to time, most of the subsequent arrangements had to be concluded by correspondence, and the bulk of the work, as usual, fell to the secretary, Dr. MacLachlan.

It was decided to recommend to the General Committee of the A.I.C. that our meetings be held in Room 7 of the Botany Building and that this should be reserved for Monday evening, June 25, and for day-sessions whenever these did not conflict with general meetings of the A.I.C.

It was assumed that the traditional Annual Dinner should again be held and, after considerable shopping around, Great Hall, Hart House, University of Toronto was chosen as the most suitable place at which to hold it.

It was unanimously recommended that Dr. Paul E. Waggoner of the Connecticut Agricultural Experiment Station, be invited as Guest Speaker for the meetings and that the choice of subject be left with him. The Secretary was requested to convey this recommendation to the President, Dr. Hanna, with the request that he should make whatever arrangements were necessary within the Deparment and extend the invitation to Dr. Waggoner.

Extended consideration was given to the possibility of holding a symposium as part of our program this year. While the committee was unanimously in favour of a symposium in principle, the idea was finally given up with regret because the chances seemed remote of holding one that would be a fitting successor to last year's highly successful one on fungicides. Several subjects suggested to or by the committee were considered to be either too regional or restricted in interest to be suitable. Of those considered suitable, no person was prepared to sponsor the project in the time available in the absence of any assurance of who were likely to be at the meetings and able to prepare papers for it. Longer range planning seems indicated but how this can best be accomplished is not apparent. It was suggested that future program committees might find it easier to arrange for symposia if the regional group in whose territory the next annual meeting was to be held were charged by the society with the responsibility of considering and, if they so decide, recommending to the program committee a symposium which they would be prepared to sponsor to the point of suggesting participants.

It is further suggested that the Program Committee for next year approach the Agricultural Pesticide Technical Society and discuss the possibility of grouping mutually interesting portions of their program and that of the C.P.S. into a joint session.

The committee expresses its appreciation for the co-operation and help it received from the Program Committee of the A.I.C. and from the Division of Botany and Plant Pathology of Science Service.

D. L. Bailey (Chairman)

REPORT OF THE PUBLICATIONS COMMITTEE

At the last annual meeting of the Society, it was decided that the Publications Committee would be continued for another year. This Committee was set up in 1952 for the purpose of representing the Society in discussions that were proceeding about that time on a proposal to divide "Scientific Agriculture" into sections. This proposal was subsequently dropped. Later on, members of the Committee took part in discussions which led up to the establishment of the "Canadian Journal of Microbiology".

In 1954, the Committee, in its report to the Society, commented on four suggestions that envisaged greater participation by the Society in the publication of papers on phytopathology. The particular suggestion favoured by the Committee was to the effect that "the Proceedings of the Society be enlarged so that all or part of the papers presented at the annual meeting could be printed in full instead of in abstract form". The report of the Committee, as presented at the meeting in 1954, was adopted, but no action has yet been taken on it. It is suggested that, if a change in the present policy on publication is contemplated, the Society might consider again the suggestions discussed in the 1954 report of the Committee.

The policy of the Society on publication may be influenced by two developments which are now being considered. The first is a proposal to divide the present "Canadian Journal of Agricultural Science" into three journals, one of which would cover the field of plant science. Papers on phytopathological and mycological subjects published in the plant science journal might be expected to receive wider distribution than they would now receive in "Canadian Journal of Agricultural Science" which covers practically the entire field of agriculture. Furthermore, by providing a new outlet, there should be less delay in publishing papers. The second develop-

ment has to do with the future policy of the A.I.C. on the question of affiliation. This question is to come up for discussion at the convention of the A.I.C. this year. If, as a result of this discussion, the Society decides to affiliate with the A.I.C., it may be possible to arrive at some arrangement whereby the A.I.C. will assist in the publication of our Proceedings. If, on the other hand, an agreement on affiliation is not reached, the Society will be free to decide on a policy of publication independently of the A.I.C.

It is suggested that the present is an opportune time for the Society to decide if it is to continue with its present policy of publishing Proceedings, or undertake something more ambitious and in keeping with its status as a scientific organization. The membership of the Society is now approximately 227, which is almost double the membership of 25 years ago. And yet the Proceedings of the first three Sessions contain a number of papers complete with tables, charts and illustrations, as well as abstracts. The first Proceedings were published with the assistance of the Department of Agriculture; the second and third were published by the C.S.T.A.

The Committee feels that there is little more that it can do until the Society gives a clear expression of its wishes in the matter of publication — whether the present form of Proceedings is to be continued, or an expansion undertaken along the lines of the suggestion favoured in the 1954 report. If this suggestion were adopted, our Proceedings would take much the same form as those of the first three Sessions of the Society. The next step would then be for a committee to examine the question of costs and bring in a report to the Society.

F. L. Drayton
G. H. Berkeley
W. F. Hanna (Chairman)

REPORT OF THE REPRESENTATIVE TO THE CANADIAN SOCIETY OF MICROBIOLOGISTS

The Sixth Annual Meeting of the Canadian Society of Microbiologists was held at Macdonald College, Quebec, June 20-23, under the Presidency of Dr. G. A. Ledingham.

Dr. E. G. D. Murray is the President-elect.

Forty-four papers were presented by members, and a symposium on parisitism was held. The special invitation speaker was Dr. Kauffman, State Serum Institute, Copenhagen, Denmark. The subjects of his special papers were: (1) "A New Antigen of *Salmonella paratyphi B* and *Salmonella Typhi murium*", (2) "On the type differentiation of Enterobacteriaceae".

The Secretary-Treasurer reported that the Society was in a fairly strong financial position, with a favourable balance of $1,837.81. Twenty-nine new members were received during the year.

The Canadian Journal of Microbiology has increased its circulation from about 750 to almost 1,000 during the past year. This number compares favourably with other publications in the Canadian Journal series. The foreign circulation is especially encouraging, so that authors are assured a wide circulation. The volume of papers presented has been quite satisfactory but the Editor would welcome papers from an even broader field.

It has been decided that the Culture Collection should be maintained as small specialized collections under the direction of men especially interested in the organisms involved. This collection will therefore consist of six-co-ordinated collections with a central punch card file.

The Seventh International Congress of Microbiology is scheduled for Stockholm, Sweden, in August of 1958, and the Eighth for Montreal, Canada, in 1961 or 1962.

The Microbiologists will hold their Seventh Annual Meeting at the University of Western Ontario, London, in June, 1957, and the Eighth Meeting at Halifax, N.S. in 1958.

Respectfully submitted,

A. R. Walker.

REPORT OF THE RESOLUTIONS COMMITTEE

Whereas the Canadian Phytopathological Society has held its 23rd session at the University of Toronto in conjunction with the Annual Meeting and Convention of the Agricultural Institute of Canada, and

Whereas the accommodations and facilities placed at the disposal of the Society have contributed notably to the success of the sessions,

Be it resolved that we extend our sincerest appreciation to :

1) Our hosts, the Central Ontario Branch of the Agricultural Institute of Canada.

2) Dr. D. L. Bailey, Chairman, and the members of his program committee for making arrangements for the meetings in the Botany Building, University of Toronto, and for the annual banquet in the Great Hall, Hart House, University of Toronto.

3) Dr. Paul E. Waggoner for his address on "Weather and Plant Diseases".

Respectfully submitted,

Wm. Newton
H. Genereux
W. C. Broadfoot (Chairman)

REPORT OF THE TERMINOLOGY COMMITTEE

During the year a terminology survey has been completed in one field of phytopathology, and the survey in a second field has been subjected to an additional revision.

The late Dr. D. C. Buckland was able to complete a final revision of the report on Terminology of Forest Pathology, with assistance from Dr. D. R. Redmond and Dr. R. Pomerleau. This report is now in manuscript form and should be submitted for publication as soon as possible, with joint sponsorship from the Canadian Phytopathological Society and the Canadian Institute of Forestry. The committee requests that the Society recommend a medium for publication. This recommendation can be submitted to the annual meeting of the Canadian Institute of Forestry that will be held later in the year.

During the year the Virus Nomenclature and Classification Committee of the American Phytopathological Society requested an opportunity to examine and comment upon the survey of "Terminology in Plant Virus Diseases" prepared by this committee. A number of useful suggestions were returned by members of the American committees. A revised survey, incorporating the best of these suggestions and of suggestions made by European workers, has been prepared, and will be circulated soon to all interested workers. If this revision meets with reasonably uniform acceptance it will be considered a final manuscript for publication, in accordance with the recommendation of the 1955 annual meeting of the Society.

W. A. F. Hagborg
B. H. McNeill
H. M. Good
T. C. Vanterpool
R. S. Willison
R. A. Ludwig
W. E. McKeen
C. D. McKeen
D. J. MacLeod
R. Pomerleau
L. E. Tyner
A. W. Henry
A. N. Langford
M. F. Welsh (Chairman)

WEATHER AND PLANT DISEASES

Paul E. Waggoner

Department of Climatology,
The Connecticut Agricultural Experiment Station, New Haven, Connecticut.

Invitation Speaker

Twenty-third Session, Canadian Phytopathological Society.

Let us begin our discussion by enumerating the benefits we hope to derive from an understanding of how environment affects the spread of plant pathogens. First, accurate forecasts of plant disease outbreaks are founded upon this understanding. And accurate forecasts are a prerequisite to economical control of disease. Ideally, growers would be informed whether disease losses would be less than or exceed the cost of control measures. A second benefit from this understanding lies in the design of control measures. If we find that a pathogen is spread in large quantities for long distances, we should join in regional control programs. If, on the contrary, we find that a pathogen is spread in large quantities for only short distances, we should concentrate on control programs on individual farms. A second improvement in control measures depends upon knowing how spore dispersal follows diurnal and weather cycles. With this information at hand we could apply fungicides at the proper time to meet the spore upon the leaf. The fungicide would be chosen more strictly upon a toxicity basis with less consideration for stability; low concentrations of the many highly fungitoxic, but unstable, materials could then be used successfully.

Weather relations of plant pathogens involve distance from the source and atmospheric turbulence, spore trapping efficiency of the host, and spore production and infectivity. A mathematical hypothesis can be derived into which these relations can be fitted. This not only will ensure that the reasoning is consistent but also will lead to deductions that might be overlooked in a less formal argument. The hypothesis is based upon a realization that the settling velocity of an air-borne fungus spore, about 1/50 m.p.h., is negligible compared to the velocity of air itself. Thus, the spread of many important pathogens is essentially a problem of travel and survival in turbulent air.

The so-called statistical theory of turbulence is useful because its parameters have easily interpreted physical meanings. This theory (5) was first applied to spore dispersal by Gregory (1). An expression for the proportion of host units infected, D, as a function of the distance, X, from the point source of the pathogen, has been derived (6).

$$D = 0.14\ p\ (Qo/K)\ X^{-15/8}\ \exp\ (-6.8pX^{1/8})$$

where p is the fraction of the spores that settle out as they move over 1 cm^2, Qo is the number of pathogens released, and K is the number of pathogens that must be deposited per cm^2 to produce a diseased host unit. Two parameters define the shape of the disease gradient or change with distance in the proportion of host units diseased: p, the proportion of spores settling out, and Qo/K, which depends upon the number of pathogens released and their infectivity.

From a study of distributions of downy mildews around point sources (6,7) the proportion of spores settling out, p, has been estimated to be 1/8—1/20. This can be compared to unpublished spore trapping data: a maximum of 10 spores/m^3 was trapped above a tobacco seedbed with about 200 blue mold lesions. Let us turn to another outbreak of blue mold: if we assume that p equalled 1/10, and the wind blew at 6 m.p.h. for a 2 h. sporulation period then 23 lesions in the source of *Peronospora* (7) should have deposited 80 spores on the tobacco plants that covered 400 cm^2 of soil. If 1/3 of the spores produced lesions, then we would get the 25 lesions per plant actually observed (7). Turning to a potato late blight epiphytotic (6), we would say from similar reasoning and the same spore trap data that the 600

lesions in the source of *Phytophthora* should have deposited 60 spores on the potato leaflets that covered 10 cm^2 of soil. If 1/600 of the spores produced lesions, then we would get the observed 10 per cent of the leaflets diseased (6). Thus, our estimates are reasonable, but much work remains to be done before one can predict accurately how many lesions a source of spores will produce.

What can be deduced about disease spread by considering the effect upon D, disease, of variation in p, proportion of spores settling out? The hypothesis shows that increasing p increases disease damage near the source, and fewer spores remain air-borne to cause damage to plants further away. As plants grow and increase the screen, p increases. Gregory's work on trapping efficiency (2) shows p will increase for larger spores, narrower leaves, and higher steady wind speeds. Therefore, maximum nearby damage is deduced to occur in tall grass or onions attacked by large-spored fungi such as *Puccinia* or *Erysiphe* while a steady wind blows. Minimum nearby and maximum distant damage is deduced to occur with erratic winds when short, broad-leaved plants such as those of strawberry are attacked by a small-spored fungus such as *Botrytis*. Thus, the behavior of p, which changes the slope of the disease gradient, must be borne in mind when forecasting disease: long distance spread by a few spores leads to more foci of infection and more rapid increase because most infection occurs within a few yards of the source. Each farmer can, therefore, control disease on his farm without too much regard for his neighbor.

The disease D at all distances is linearly proportional to the second paramater, Qo/K. Many effects of weather upon disease operate through their effects upon this parameter. The dimensions of Qo/K, which lead to its interpretation, are (pathogens emitted) times (lesion/pathogen) times (cm^2/unit diseased).

First, weather affects emission. Unpublished data obtained by operating an efficient spore trap (3) over a seedbed of blue mold infected tobacco has provided us with an example. No *Peronospora* spores were air-borne at night. On a clear day the maximum discharge occurred at 0530 h and none appeared after 0930 h. On a cloudy day the maximum was not reached until 0930 h and the spores did not disappear from the air until 1930 h. Consequently, the number air-borne on a cloudy day was 20 times the number on a clear day.

The second factor included in Qo/K is "lesion/pathogen". Many pathogens require 50-70°F. and free water for germination following little if any drying. The spore trap data just cited and that of Hirst (4) show that downy mildew spores are disseminated in the morning. Therefore, afternoon conditions are of paramount importance in the survival and infectivity of these important groups of pathogens; nighttime coolness, dew ,or thundershowers must be less important.

Finally, the parameter Qo/K includes a term "cm^2/unit diseased". The larger the unit a single pathogen infects, the greater the damage or proportion of the crop diseased. In the case of a pathogen that produces local lesions this term is small. *Phytophthora infestans* and *Puccinia graminis* are examples. In the opposite case of a pathogen, say a wheat smut, that infects a plant systematically, this term — and disease damage — are large. Needless to say, size of unit infected is a consideration in forecasting disease.

Size is also a consideration in designing fungicides to prevent spread: if the unit is small, even a partially effective material is helpful. However, if the size is large and, hence, exposed to multiple hits by pathogens, only a nearly perfect control measure is worthwhile.

This discussion of weather and plant disease has shown one way of thinking about them. A mathematical model or hypothesis has been used to organize the discussion and arrive at deductions not yet verified experimentally. This should assist us both in present disease control and direct us in further experiments.

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ABSTRACTS OF PAPERS PRESENTED AT THE TWENTY-THIRD MEETING OF THE CANADIAN PHYTOPATHOLOGICAL SOCIETY

INVESTIGATIONS OF THE PHYSIOLOGICAL PREDISPOSITION OF RED CLOVER PLANTS TO ROOT AND CROWN ROT

L. V. Busch, Ontario Agricultural College, Guelph, Ontario.

Observations of red clover fields affected with root and crown rot suggested that some factor or factors was predisposing the plants to invasion by organisms which normally are either non-pathogenic or at best, very weakly so.

Information obtained from chart quadrats and field observations suggested that the root and crown rot did not appear until the plants entered the reproductive phase of growth and that it was more severe in fields low in potash, phosphate or both. In addition, red clover plants grown at 18 hours photoperiod at which interval they are strongly reproductive, frequently exhibited root rot symptoms similar to those found in the field while vegetative plants grown at 12 hours a day length rarely exhibited any.

Field symptoms were reproducible in the light chamber by inoculating red clover plants, grown at 18 hours day length, and fed with a low P & K or -K nutrient solution. No diseased plants were found in a similar set grown with a high P &K or high K nutrient solution.

EFFECT OF *ASPERGILLUS* SPP. ON THE GROWTH AND MORPHOLOGY OF *SPHAERONAEMELLA FIMICOLA*

R. F. Cain, University of Toronto, Toronto, Ontario.

No abstract submitted.

SIDELIGHTS OF POTATO FUNGICIDE TESTS

L. C. Callbeck, Science Service Laboratory, Charlottetown, P.E.I.

The results of several years have shown that the dimethyl carbamates are much inferior to the ethylene carbamates in the control of late blight of potato. In the ethylene group factory-prepared fungicides have been superior to tank-mix preparations. This difference is probably associated with rate of decomposition, and may be theoretically explained as follows. Carbamates are themselves poor fungicides, but on exposure they are decomposed into highly spore toxic principles. It is probable, then, that these necessary reactions have already started in the packaged goods on the shelf, making them immediately more efficacious when applied to the plant than are the freshly-made tank-mixes.

The salt maneb (manganese ethylene bisdithiocarbamate) has been the leading fungicide in the Charlottetown Screening Tests, but some differences in disease control have been manifested among the trade name sources.

INFECTION OF BARLEY FLORETS BY *CLAVICEPS PURPUREA* TUL.

W. P. Campbell, Plant Pathology Laboratory, Edmonton, Alberta.

Newal barley was grown in the greenhouse and inoculated with a conidial suspension of the pathogen by injecting the spores into the florets with an atomizer at the time the host was in blossom. Florets were collected at 24 hour intervals for a period of two weeks.

By the third day following inoculation fungus mycelium was well established within the ovary around the base of the ovule. The mycelium grew upward from this point toward the stylar end of the ovary and surrounded the ovule. By the sixth day following inoculation the latter body was an island of intact tissue surrounded by the fungus. At about this time the hyphae began to penetrate the nucellus and

colonized the embryo sac. Simultaneously hyphae began to grow outward through the epidermis of the ovary wall where a layer of conidiophores soon developed. Generally, "honey dew" was secreted within seven days following inoculation, and sclerotia had formed before the end of the second week.

A FLOTATION-VIABILITY TEST FOR EVALUATING SOIL FUNGICIDES, WITH *HELMINTHOSPORIUM SATIVUM* AS TEST ORGANISM

S. Chinn, Plant Pathology Laboratory, Saskatoon, Saskatchewan.

A laboratory method is described for determining the effectiveness of soil fungicides. It is based primarily on the flotation-viability test which consists of two phases, namely, recovery of fungal spores from fungicide-treated soil and the subsequent determination of their viability. The applicability of this method was established by studies of the effect of 24 fungicides on conidia of *Helminthosporium sativum* in soil and on the persistence of four of these fungicides in soil. The results were confirmed with a seedling test.

THE MOST RECENT APPROACH IN THE CONTROL OF LOOSE SMUT OF BARLEY — MECHANISM AND APPLICATION

S. H. F. Chinn and R. C. Russell, Plant Pathology Laboratory, Saskatoon, Saskatchewan.

It was shown that the control in the water soak treatment for loose smut of barley is due to the development of the hyphae under favorable environmental conditions and not by the inhibition of the hyphae by metabolites during the treatment. This conclusion was arrived at by experimentation with various salt concentrations in the water during the soaking period and confirmation by the culturing of *Ustilago nuda* on potato dextrose agar which was prepared with similar concentrations of salt in it.

The practicability of the dip and pile technique which was developed at this laboratory for the control of loose smut of barley was improved by the addition of salt to the dip water. This modification eliminated sprouting of the seed during treatment and seems to have a favourable effect on emergence. The treatment may be applicable to the control of loose smut of wheat.

EFFECT OF ENVIRONMENTAL FACTORS ON DEVELOPMENT OF SNOW MOLD

M. W. Cormack, Science Service Laboratory, Lethbridge, Alberta.

Snow mold infection of alfalfa, grasses and winter wheat was artificially induced in the controlled temperature rooms at Lethbridge. Greenhouse-grown plants were conditioned under artificial lights at 5° C. for one week prior to inoculation. The low temperature basidiomycete that causes most of the damage in Western Canada required a temperature near freezing (2—4° C.) for the infection period of 6 to 8 weeks. A high relative humidity (90—95 per cent) was most favorable for mycelial growth and infection, but a saturated soil and atmosphere were deleterious. Freezing temperatures and a snow cover were not necessary, but a closed cabinet or other covering was required. The temperature and moisture requirements for infection by *Typhula* spp. and *Sclerotinia borealis* have not yet been accurately determined.

STUDIES ON THE CELL-KILLING ACTION OF EXTRACTS FROM *BOTRYTIS CINEREA* AND *BACTERIUM AROIDEAE*

S. G. Fushtey, Ontario Agricultural College, Guelph, Ontario.

Pectolytic enzyme preparations extracted from liquid cultures of *Botrytis cinerea* and *Bacterium aroideae* exhibit the power of macerating plant tissues and killing the cells. The macerating principle is known to be enzymic in nature but the killing action is not clearly understood.

Experiments carried out under a variety of conditions involving pH, temperature, concentration of enzyme, dialysis, partial maceration and presence of degradation products showed that any treatment which stopped or slowed down enzymic activity likewise stopped or slowed down toxic action. When experiments were conducted in the presence of a plasmolysing concentration of a crystalloid such as potassium nitrate, sucrose, urea, etc. the killing action was retarded out of all proportion to any effect on enzymic action. This effect was shown to be one of resistance imparted to the protoplasts by plasmolysis. Protoplasts which had been recovered from plasmolysis were equally as susceptible as fresh ones. Plasmolysis exhibited a similar retarding effect on the toxicity of chemicals such as mercuric chloride and oxalic acid.

Degradation products resulting from enzymic maceration of experimental tissues exhibited no toxic properties, but such maceration did tend to increase hydrogen ion concentration in the experimental solution. Hydrogen ion concentrations in excess of pH 5 were highly toxic to the tissues involved. Although the pH of the experimental solutions did not, in any instance, reach a toxic level it is conceivable that a toxic concentration of hydrogen ions may develop in the immediate vicinity of the protoplast but become neutralized in the surrounding solution.

On the basis of present knowledge two theories are presented in explanation of the cell-killing action :

(1) That proposed by a previous worker (Tribe) — that the pectorytic principle kills the cells by degrading some pectic substance occurring as a vital component of protoplasmic structure.

(2) That arising out of the present work — that the degradation of pectic materials in the cell wall builds up a concentration of hydrogen ions which is toxic to the protoplasts.

STUDIES ON THE NUTRITIONAL REQUIREMENTS OF *PHYTOPHTHORA INFESTANS* (MONT.) DE BARY

W. A. Hodgson, Plant Pathology Laboratory, Fredericton, N.B.

Studies on the nutritional requirements of races of *Phytophthora infestans* have resulted in the development of a synthetic medium which supports good growth of races 1, 2 and 1, 2, 3 but little or no growth of races 0 and 1. The inability of races 0 and 1 to grow in this medium is apparently not due solely to a requirement for a source of nitrogen other than asparagine or to a deficiency for any one of twenty amino acids. Growth of races 0 and 1 was stimulated by the addition of ascorbic acid to the medium, but eleven other vitamins tested had no apparent stimulating effect. Asparagine was found markedly superior to ammonium and nitrate salts as a source of nitrogen for both races 1, 2 and 1, 2, 3, but differences were observed in the ability of these two races to utilize certain amino acids.

A VIRUS LATENT IN TURNIPS

J. P. MacKinnon, Plant Pathology Laboratory, Fredericton, N.B.

Previously reported studies have shown that green peach aphids reared on turnip stecklings acquired a virus that was transmitted to plants of *Physalis floridana* Rydb. and *P. pubescens* L., hosts used in potato leaf roll studies. Further studies showed that aphids born on infected *P. floridana* were over 80 per cent infective after feeding five days on these plants. When each of these aphids was transferred to a new test plant each day, they continued inciting infections as long as they lived. Some aphids infected nine consecutive plants, while others incited infections intermittently. Molting did not affect the infectivity of aphids but nymphs born of infective adults did not transmit the virus. The aphid transmission of this virus resembles that of potato leaf roll.

COMPLEXES OF STRAWBERRY LATENT VIRUS AND OTHER STRAWBERRY VIRUSES

Frances C. Mellor and R. E. Fitzpatrick, Plant Pathology Laboratory, Vancouver, B.C.

Combinations of strawberry latent virus with veinbanding virus causes symptoms on *Fragaria vesca* known as leaf curl; on the Marshall variety symptoms are similar to those of the field disease "crinkle", and on the British Sovereign symptoms are of the same type as, but much milder than, those on Marshall. When mild yellow edge virus is added to this combination, *F. vesca* reacts with symptoms indistinguishable from those of the xanthosis produced by a combination of mottle, strawberry latent, and mild yellow edge viruses.

THE PHYSIOLOGY OF *XANTHOMONAS PHASEOLI* AND *X. PHASEOLI* VAR. *SOJENSIS* IN RELATION TO THEIR PATHOGENICITY

R. L. Millar, Botany and Plant Pathology Laboratory, Ottawa, Ontario.

The pathogen-suscept relationships of *Xanthomonas phaseoli* (E.F. Sm.) Dowson and *X. phaseoli* var. *sojensis* (Hedges) Starr and Burk. were investigated primarily on the bases of 1) antibiotic phenomena and 2) physiology of the organisms in relation to their pathogenicity. No evidence was obtained to indicate that the restricted pathogenicity of the two pathogens might be explained on the basis of specific antibiotics present in plant tissues. The results of studies employing supplemented and nonsupplemented basal media suggest that the pH of the plant tissues should be considered in any approach to an understanding of a pathogen-suscept relationship.

THE EFFECT OF SEVERAL SUGARS ON ASCOSPORE FORMATION IN *SACCHAROMYCES.*

J. J. Miller, Department of Biology, McMaster University, Hamilton, Ont.

Saccharomyces cerevisiae offers a number of important advantages as an experimental subject for studying the physiology of ascospore formation. Using a liquid sporulation medium consisting of M/30 phthalate buffer of pH 5 plus glucose, fructose, mannose, or galactose in concentrations of 0.05 to 1%, asci were found to be most abundant at 0.05%. With glucose, fructose, and mannose the optimum concentration for 3-and 4- spored ascus formation was 0.1%. Few cells formed ascospores at the higher concentrations of these three sugars, but this was not so with galactose. Since the addition of acetate, which by itself promotes sporulation, to the sugar solutions did not increase yields, it seems that sporulation is inhibited in some manner by the higher concentrations of glucose, fructose, and mannose. A triose, dihydroxyacetone, compared well with the hexoses in promoting sporulation. Optimum yields occurred at 0.1%, with a marked decline at the higher concntrations. Twenty-four hour growth experiments were done in yeast nitrogen base (Difco) containing the same range of sugar concentrations. All the hexoses supported abundant cell multiplication, especially galactose, but with dihydroxyacetone no growth was evident.

THE TOXICITY OF *D*-ALANINE AND *L*-LEUCINE TO WHEAT SEEDLINGS AND GROWTH STIMULATION BY *L*-ALANINE

William Newton, Plant Pathology Laboratory, Saanichton, B.C.

Under aseptic conditions the growth of wheat seedlings was strongly inhibited by complete nutrient solutions containing either *d*-alanine or *l*-leucine as the nitrogen sources, and the inhibition was markedly greater than that effected by the complete absence of nitrogen. In contrast, growth was stimulated by *l*-alanine, being greater than that as supported by nitrate. Growth as supported by urea or *l*-asparagine was normal or equivalent to that supported by nitrate. The evidence of the toxicity of *d*-alanine and *l*-leucine and of growth stimulation of *l*-alanine throws new light upon the physiology of the wheat plant.

THE INFLUENCE OF LIGHT ON *BOTRYTIS SQUAMOSA*

O. T. Page, Ontario Agricultural College, Guelph, Ontario.

No abstract submitted

A PROCESSING AND SECTIONING PROCEDURE FOR STUDY OF LOOSE SMUT INFECTION IN DORMANT EMBRYOS OF WHEAT GRAINS

W. Popp, Plant Pathology Laboratory, Winnipeg, Manitoba.

Embryos of wheat grains are extracted and cleared in potassium hydroxide, washed in water and embedded in soap affixed to glass slides. The slide bearing the tissue to be sectioned is placed on an improvised platform in the knife clamp of the rotary microtome. The cutting knife consists of a section of a safety razor blade in the special holder designed for the instrument and is mounted in the object carrier. Thickness of sectioning is controlled by manipulation of the crank on the left hand side of the instrument. After washing out the soap in water, the sections are cleared briefly in a solution of iso-propyl alcohol, lactic acid and propionic acid and then are stained and mounted in cotton blue in lacto-phenol. By use of this method it is possible to prepare rapidly uniform parallel sections with structure and loci of the hyphae of loose smut clearly revealed in the transparent host tissue.

SPORULATION STUDIES IN THE GENUS *FUSARIUM*

James Reid, University of Toronto, Toronto, Ontario.

No abstract submitted

LONGEVITY STUDIES WITH WHEAT SEED AND CERTAIN SEED-BORNE FUNGI

R. C. Russell, Plant Pathology Laboratory, Saskatoon, Saskatchewan

The longevity of several lots of wheat seed with cracked seed coats was compared over a period of 17 years with that of several sound coated seed lots. At the beginning of the test the average germination of the former lot was 4 per cent lower than that of the latter. This spread increased to 12 per cent and remained at that level for about 9 years, but for the last 4 years there was little difference in the germination of the two lots. In a general way all seed lots germinated well for about 9 years then the seed lost its viability rapidly until at the end of 17 years nearly all the seed was dead.

The longevity of two seed-borne fungi, *Helminthosporium sativum* and *Alternaria tenuis*, on wheat seed was compared. *A. tenuis* disappeared in about 7 years. *H. sativum* lost its viability more slowly. Eight per cent of the original amount appeared on the germinating seed at the end of 17 years.

THE VIRUS COMPLEX CAUSING RASPBERRY MOSAIC IN BRITISH COLUMBIA

R. Stace-Smith, Plant Pathology Laboratory, Vancouver, B.C.

It has been shown that the mosaic disease of red raspberry is the result of multiple infection by two separate viruses. Since these viruses, Rubus yellow-net and black raspberry necrosis, have a common vector, the aphid *Amphorophora rubi* Kalt., and are both non-persistent, they are usually transmitted together and the complex nature of the mosaic disease can best be demonstrated by synthesis. Diseased plants have not been cured by heat therapy; treatments of 10 days at 100°F. have removed the black raspberry necrosis component but the Rubus yellow-net component was not inactivated.

A POLYVIRULENT PHAGE FOR *XANTHOMONAS* SPECIES

M. D. Sutton, Botany and Plant Pathology Laboratory, Ottawa, Ontario.
and H. Katznelson, Bacteriology Division, Science Service
Ottawa, Ontario.

The isolation of a polyvirulent phage for *Xanthomonas* species from swede seed was described. Specificity tests indicated that 43 of 58 phytopathogenic strains of *Xanthomonas* representing 25 species were lysed by this phage. Nutritional and temperature studies of this phage with *X. campestris* showed lysis was best and complete in nutrient broth alone after 18-24 hours incubation at 26-28°C. Plaque production was greatly influenced by temperature and agar concentration. Clear pin point plaques were produced in agar layer plates after 24 hours at 27°C.

One-step growth studies of Pg-125 phage made with shake cultures of *X. campestris* indicates that absorption in the host cell virus mixture was 40% after 30 min. The number of phage particles absorbed per bacterium was 0.23. The latent period was 210 minutes, the rise period 60 minutes and burst size 4.6. Electron micographs of Pg-125 phage revealed particles with heads 60 mu in diameter, tails 180 mu long and 10-15 mu wide.

VARIATION IN THE FUNGUS FLORA OF BARLEY SEED

H. A. H. Wallace, Plant Pathology Laboratory, Winnipeg, Manitoba.

Twenty genera of fungi were found on the surface of unsterilized barley seed incubated on moist filter paper in Petri dishes. The genera encountered most frequently were *Alternaria, Trichothecium, Cladosporium, Helminthosporium* (mostly *H. sativum),* and *Spicaria* (?). Infection by *Penicillium* and *Rhizopus* was rare and appeared to be confined to mechanically injured seed. The fungus flora varied with the area in which the seed was produced, but in these areas it was fairly consistent from year to year. It was also observed that barley varieties tended to differ in the fungi infesting the seed, and the ratio of infestation was approximately the same, regardless of where and when the seed was produced.

THE SYSTEMIC ACTION OF ACTIDIONE

V. R. Wallen and R. L. Millar,
Botany and Plant Pathology Laboratory, Ottawa, Ontario.

A systemically active substance has been extracted from wheat plants which were supplied actidione at concentrations from 25 to 500 p.p.m. both as an aqueous spray application and when supplied to the root system of wheat plants growing in quartz sand and in three types of soil, sand, sandy loam, and heavy clay. This systemically active substance was demonstrated by plating directly on agar seeded with *Saccharomyces pastorianus,* and extracted with chloroform followed by a paper-disc assay. The substance was found to persist for at least six weeks both when used as a spray and absorbed through the root system at 500 p.p.m.. Paper chromatography was employed to demonstrate that the active substance was chemically similar to actidione.

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